standing thick film (i.e., is greater than 1000 W/mK), has a Raman Full Width at Half Maximum (FWHM) of less than 10 cm^{-1}, and preferably less than 5 cm^{-1}, which is an indicator of diamond coating purity and quality, and optical absorption and transparency.

The thin film diamond coating may be coated upon substrates and various component surfaces using a chemical vapor deposition (CVD) system, e.g., d.c. arc jet, hot wire, or microwave energy CVD system. Referring to Fig. 1, with respect to a d.c. arc jet CVD system, for example, a CVD system 100 includes a hollow, tubular cathode 102 located near the top end of a hollow barrel 104 in a metal jacket member 106. The jacket member 106 has an annular space 108 suitable for holding a fluid coolant. The barrel 104 and jacket member 106 are surrounded by a fluid-cooled magnetic coil assembly 110. Longitudinally spaced at the end of the barrel 104 opposite that of the cathode 102 is an anode 112. The anode 112 has a central opening (not shown) aligned with the axis of the barrel 104 and leading to a nozzle 114. The nozzle 114 opens into an evacuated deposition chamber 116 which has a preferably liquid-cooled mandrel 117 on which a deposition substrate 118 is spaced from the end of the nozzle 114. A first gas injection tube 120 located at the anode 112 injects gas into the central opening of the anode 112. A second gas injection tube 122 is located between the anode 112 and the nozzle 114.

In the operation of the system 100, hydrogen gas is injected through the first injection tube 120 at a predetermined rate. Between the anode 112 and the nozzle 114, more hydrogen gas, mixed with methane or another hydrocarbon, is injected through the second injection tube 122. The concentration of methane is based on the total percentage of methane injected as a volume percent of the total gas injected through both injection tubes 120, 122. A direct current arc is struck